

Designing Infrastructure to Eliminate Mosquito Colonization

by Jim Shaffer

In a previous *Wing Beats* article (Vol 21, No 4), the Washoe County Health District Vector-Borne Diseases Program provided the process and steps of establishing regulations that allow for design standards on new public and private development projects to eliminate mosquito colonization. This article describes requirements established by the Vector-Borne Diseases Program (VBDP) in collaboration with Community Development Departments in Reno, Sparks and Washoe County used during review and approval of retention basins, channels, landscape improvements, ponds, wetlands and catch basins to reduce the impact of nuisance insects, including mosquitoes.

Instead of reacting to mosquito issues caused by poorly designed development projects, our approach is to collaboratively work with planners and civil engineers to establish better designs based on regulations to minimize the nuisance and public health risks associated with mosquitoes.

Detention basins are required by local government to store water runoff from large storm events in order to reduce down stream flooding. If not designed properly, these areas provide an ideal larval habitat for nuisance insects. To alleviate this, the VBDP requires a cobble line (4-6 inch rock) low flow channel between the inlet(s) and outlet pipe. This allows water

flow that often occurs from over watering landscape to trickle through these facilities without reducing the capacity of the basin to handle large storm events.

Moreover, an infiltration trench 2 feet wide and 3 feet deep (depending on soil profile) is constructed below the low flow channel between the inlet and outlet pipe to provide additional infiltration. VBDB also requires no vegetation plantings within one foot of the low flow channel. Specific maintenance language is provided to Homeowners Associations (HOAs) and Landscape Maintenance Associations (LMAs) to maintain the basins annually. For retention basins we require the

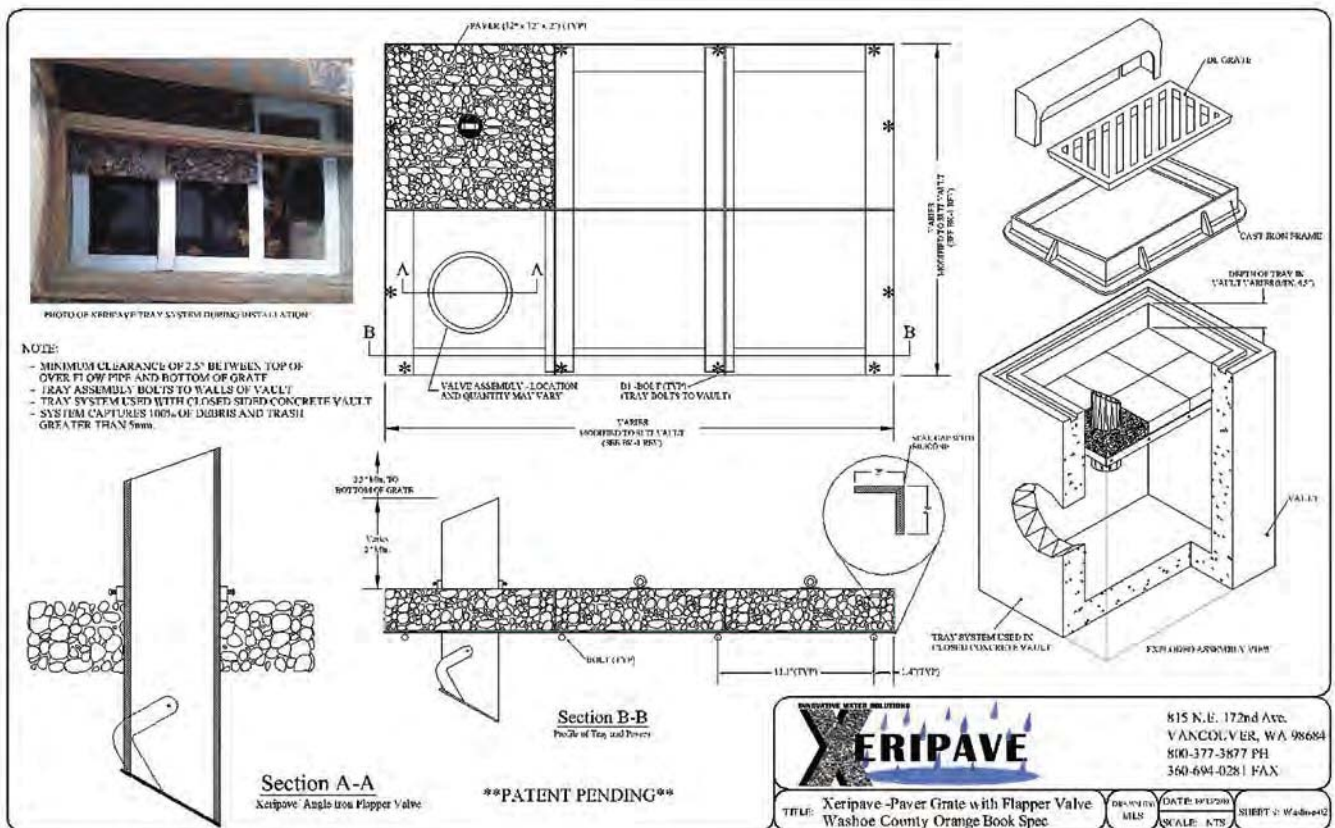


Figure 1: The paver tray system for catch basins.



Figure 2: Landscape xeriscape buffer to reduce water runoff in catch basins.

same designs for infiltration, maintenance and a low flow channel constructed from the inlet to the length of the basin since there is no outlet in these facilities.

The program is a strong proponent of Low Impact Development (LID) designs that have been used in Reno, Sparks and Washoe County under the guidance of the Truckee Meadows Storm Water Permit Coordinating Committee. Low Impact Development is storm water management modeled so runoff from rainfall and urban uses is captured, filtered, stored, detained and infiltrated at its source. Features such as bio swales, rain gardens and curb cuts to landscape areas captures and infiltrates water runoff, reducing these waters from entering the hard infrastructure system. When LID plans are distributed to our program, infiltration systems are added for additional percolation.

Typically, new drainage channels are designed to be constructed as flat bottom channels in Reno,

Sparks and Washoe County. Over time with little maintenance, these channels build up sediment and lose their constructed grade resulting in water "ponding." To avoid this, the program requires a low flow channel which allows water to flow through the facility while having the capacity to accommodate large storm events. Depending on the project and who is responsible for maintaining the structure, the low flow channel is lined with cobble rock (4-6 inch rock).

Landscape designs that contain turf for residential and commercial common areas are required to have an 18 inch xeriscape buffer from the back face of side walk or other impermeable surfaces. Over watering turf during the summer months creates nuisance water to enter this landscape buffer and infiltrates as opposed to running down the curb and ponding in catch basins. If a curb exists without a sidewalk the buffer is the same 18 inches. The VBDDP also directs the landscape architect

to place a wind sensor control unit at the site in which the irrigation system shuts off when the wind exceeds a specified speed reducing nuisance water runoff.

Ponds provide an aesthetic feature in new developments and can be used to capture storm water runoff. They afford habitat for non-biting nuisance midges, which the VBDDP has no pesticide material to combat. As a control measure, ponds are constructed with a fountain aerator or multiple aerators and operated daily for two hours in the morning and evening annually from April through October. The agitation of the surface water from the aerators discourages adult female mosquitoes and midges from laying their eggs. The aerators improve water quality by preventing algae and weed formation by oxygenating the water through mixing. Our program also requires cobble rock placed two feet below and two feet above the mean water line. This reduces weed growth used as habitat for mosquito and



Figure 3: Our design standard of a cobble line low flow channel for detention/retention basins.

midges while minimizing the burrowing of rodents.

In addition, our program developed a wetland model design using a meandering low flow channel in which storm water runoff from development flows through the wetland. Ponds can be constructed and connected to the low flow channel with water flowing into and exiting the pond through the meandering channel system. Forebays are constructed below the outfall pipes which capture sediment, debris and urban litter from development discharges from entering the wetlands. Included in our wetland design are native plants associated with our high desert environment planted on the upland slopes. Our experience in wetlands is if an unmanaged monoculture, such as perennial pepper weed (*Lepidium latifolium*) and/or cattails (*Typha* spp)

is allowed to exist, it out competes a desirable and diversity of plant species creating an environment conducive to mosquito development.

The Cities of Reno, Sparks and Washoe County Community Development require rockery walls and mechanically armoring slopes to stabilize hillsides as development moves off the valley floor. The Vector-Borne Diseases Program has standards for rockery walls, by filling the voids with smaller rock in the rockery wall for the entire height. For slope stabilization of hill sides, mixed aggregate rock is placed in the voids to a depth of 3 inches. With plague endemic in Washoe County, these design standards also discourages void formation for rodent habitat.

The VBDP began a collaborative effort with Washoe County Com-

munity Development and Jensen Precast to design new as well as retrofitting existing catch basins/drop inlets (DIs) that improves water quality and at the same time prevents the colonization by mosquitoes. Our first design was developed in 2008 with Jensen Precast modifying the basin by placing 1 inch diameter weep holes on the side walls and end walls of the DIs. As water enters the basin from the curb it will weep out through the one inch diameter holes in the basin, eliminating any standing water in the sump. Unfortunately, our design was not approved by Reno and Sparks because the weep hole catch basin was considered an injection well by definition of the Nevada Department of Environmental Protection (NDEP).

In 2009 work began with Washoe County and Xeripave which manufactures pervious pavers to

eliminate the amount of debris, organic matter and pollution by collecting this material below the grate and on the pavers while preventing this material from entering water ways that flow directly to the Truckee River. We initiated demonstration projects with Washoe County and Reno testing for sediment clogging and using a water truck to simulate large storm events to determine if the Xeripave Tray System met Washoe County hydrological standards. Over a two year period the testing culminated in the Xeripave Tray System design being placed in the Washoe County Hydrology Manual. The Xeripave installed below the existing grate and above the outfall pipe prevents access for adult mosquitoes. As a result of the demonstration projects, the Vector-Borne Diseases Program is requiring this retrofit in catch basins.

With our review of new developments through the Community Development process, what assurances do we have that our design standards are constructed as required on the civil/building plans? In 2009 we developed a Compliance Inspection Handbook that contains our design standards to initiate on site compliance. As contractors work on the project, they contact VBDP for a compliance inspection, which allows us to examine their work to ensure standards established for public and private infrastructure construction are followed.

When the Vector-Borne Diseases Program regulations were approved in 2002, little did we realize the positive effects it would have on infrastructure through our planning in Community Development. It is through these designs that the citizens of Washoe County have benefited.

The "prevention through design" approach undertaken by the Washoe County Health District Vector-Borne Diseases Program has transitioned our program from reliance on the use of pesticides for insect control, to becoming proactive through the Community Development process.



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